

# The Solar Trough Organic Rankine Electricity System (STORES)

A Presentation to SunLab's Solar Trough Workshop  
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***Reflective Energies***

**Bibb and Associates (formerly Ben Holt Co)  
KJC Operating Company**



## The STORES Goal: Cost-Effective Solar Trough Power Using Proven Technologies

- Trough technology is approaching a high temperature plateau
- There are many remote desert areas where power is needed at night, even in summer
- Nights are much cooler than days, and winters significantly cooler than summer in many of these places
- The ORC can take advantages of these temperature differences
- Standardized, 10 mw power plants with built-in storage can deliver electricity day-or-night, with significantly improved summer efficiencies
- No other fuel will be needed; no need for the expense of ISCCS or other hybrids
- More rapid path to commercialization; larger Trough+ISCCS Projects take too long; cost too much; have not found recent success,. Smaller, Solar-only plants may find speedier markets



<http://www.stores.com>

- high temperature thermal problems
- very valuable watts
- Solar Trough Organic Rankine Electricity System
- Create Other Methods

# The Potential for Modular Commercial Trough Power Plants With Storage

- Solar Trough Technology is Commercial
- Low Temperature Organic Rankine Cycles Are Commercial
- Storage Has Not Been Commonplace with Trough Plants
- Many Solar Sites Have a Significant Difference Between Day and Night Temperatures
- With Proper Design, Energy Stored During the Day Can Result in Increased Output During Cooler Nights
- With Proper Design, Winter Output Can be Significantly Increased For Similar Reasons

## Solar Troughs Are Commercial

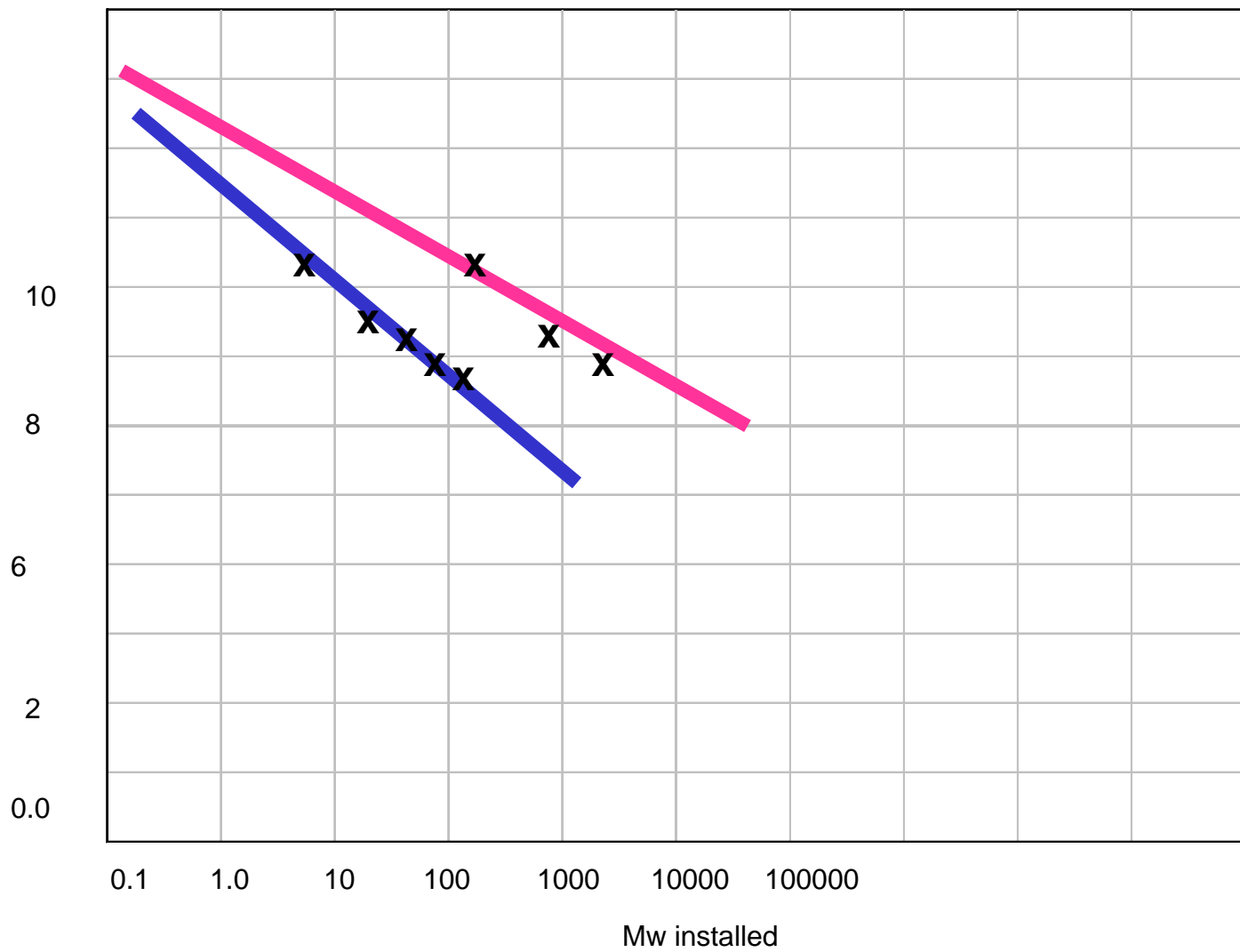
- Advantages of Solar Troughs are Well Documented
- Current Technology Limits the Maximum Fluid Temperature at  $\sim 750^{\circ}\text{F}$
- Fluid Temperature is Limited by Fluid Properties
- Troughs are Commercial
- Fluids below 600 F cost about \$1-1.50 a gallon
- Fluids above 700 F cost \$8+ a gallon
- Storage Differential Costs between low temperature and high temperature fluids Alone are several hundred dollars per kW

## ORCs are commercial

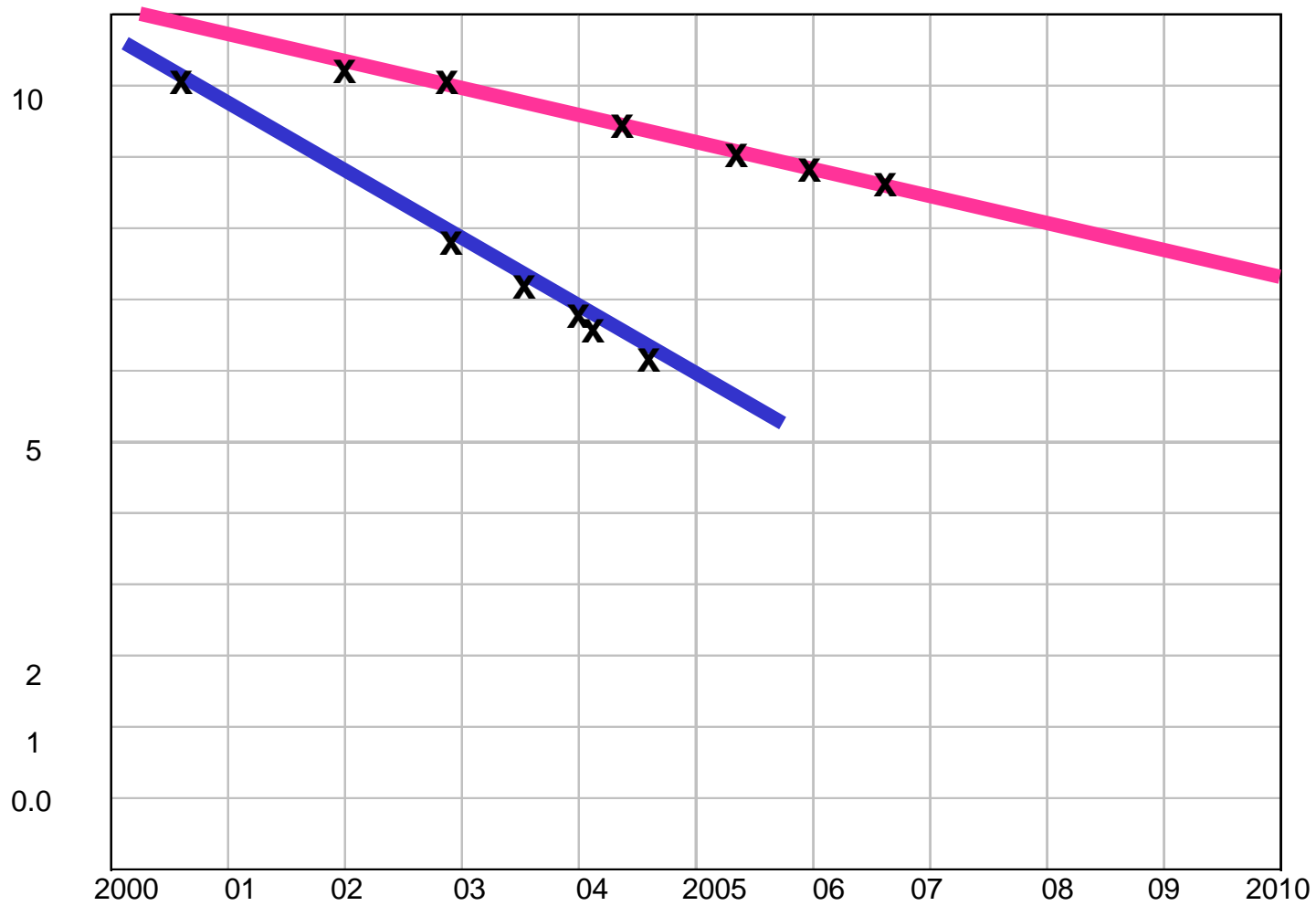
- There are 30 mw of Geothermal ORCs running for almost 10 years at Mammoth, California
- There are 10 mw of Geothermal ORCs running at Mammoth for 15 years
- There are 30 mw of Geothermal ORC's running at Steamboat Springs, Nevada for 7 years
- ORCs with Dry Cooling Towers produce significantly higher output when ambient temperatures are cooler. They use practically no water
- ORCs avoid vacuum pumps and air ejectors
- ORCs startup much quicker than steam plants
- O&M costs are lower

## Advantages of STORES

- Cost-effective storage
- Generate more electricity on an annual basis than steam plants
- Needs very little water, a scarce commodity in deserts
- Needs no other fuel
- The Cascade ORC may be able to improve efficiency and take advantage of temperature differentials
- The Learning Curve will be rapid. The ORC components can be manufactured and assembled “cookie-cutter” for rapid deployment and economies of production. For the price of one large ISCCS, several 10 mw STORES plants can be installed
- Simpler than ISCCS; easier to site. Easier to find high-value applications with high electricity prices
- Can be base-load, swing load or peaking, as needed

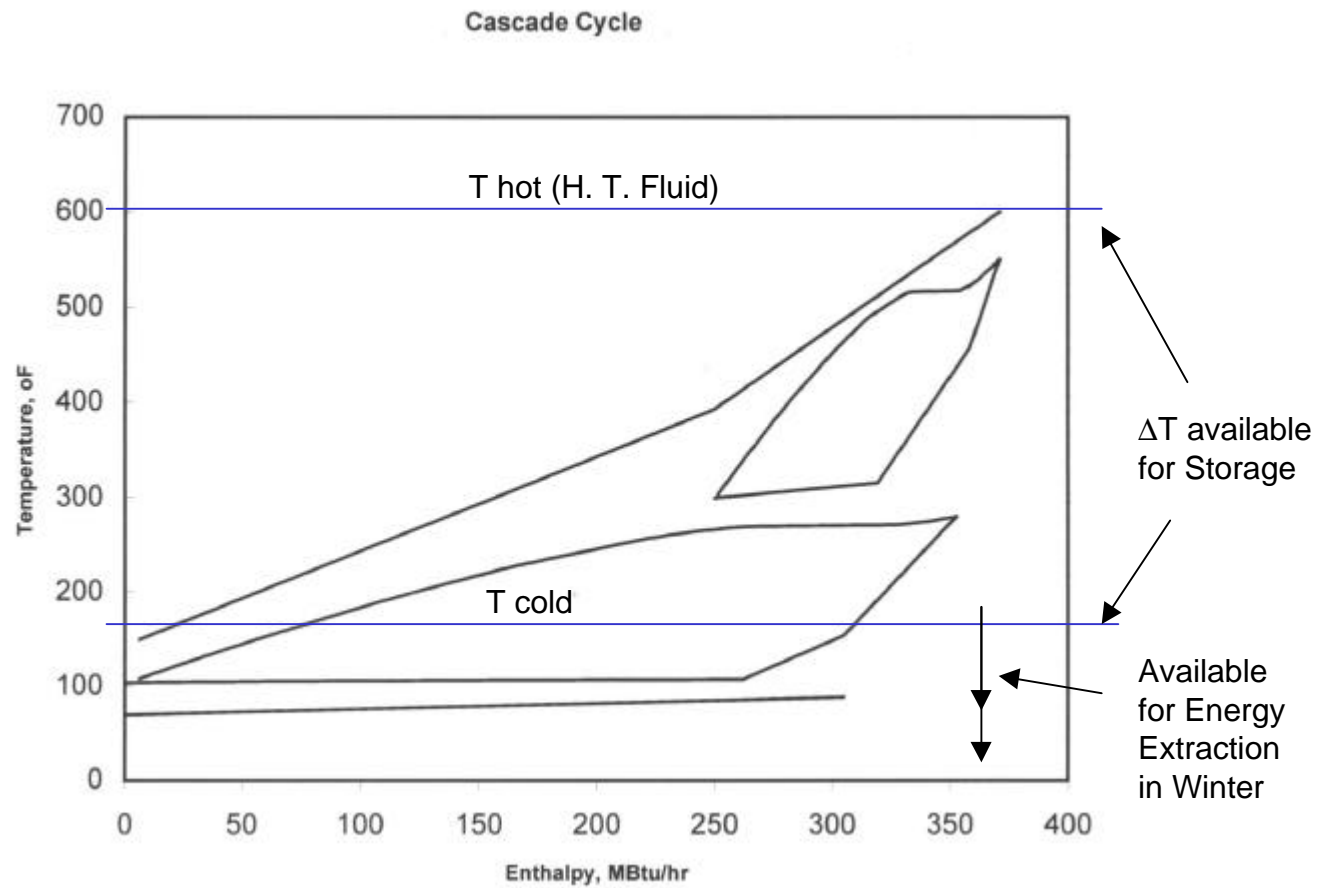






## Next Few Steps

- Develop the Design Criteria for a STORES plant (complete)
- Basic Design for a STORES Plant; evaluate potential performance compared to Steam Systems
- Evaluate Potential Sites and Select a Site
- Develop Cost Comparisons and prepare a cost-benefit analysis



**The STORES System: A Cascade ORC Coupled to a Trough Project with 600 F HTF**